

Remarks/Arguments

The Examiner is thanked for the careful review of this application. Claims 1-10 and 16-20 are pending after entry of the present Amendment. Claims 11-15 were cancelled. New claim 21 was added and claims 6 and 16 were amended. This Amendment is being presented in the new format, as suggested.

Rejections under 35 U.S.C. § 103:

The Office has rejected claims 1-8, 10, and 16-20 under U.S.C. 103(a), as being unpatentable over United States Patent 5,242,532 to Cain in view of United States Patent 5,198,072 to Gabriel. In a like manner, the Office has rejected claim 9 as being unpatentable over Cain in view of Gabriel and further in view of the United States Patent 5,843,8115 to Liaw. Applicants respectfully traverse the Office's rejections and submit that independent claims 1, 6, and 16 are patentable over the cited references, as no combination of the cited prior art would have suggested the claimed invention to one of ordinary skill in the art.

Cain focuses on methods and systems for detecting the completion of a plasma etching of a particular layer. In doing so, Cain teaches using a second layer or a marked sacrificial layer as an endpoint signal. As acknowledged by the Office, Cain does not teach or disclose the step of monitoring the bias compensation voltage of the plasma in the plasma chamber during the plasma etching or discontinuing the plasma etching once the endpoint signaling change in the bias compensation voltage is detected.

The second cited reference, Gabriel, teaches monitoring the impedance level of a wafer to determine when a specific layer being etched is just about to be etched-through. According to Gabriel, the impedance of the substrate changes just prior to the etch-through of the dielectric layer. As such, Gabriel implements a two-step etch process. First, Gabriel implements a plasma etch process to etch the dielectric layer until just prior to the etch-through of the dielectric layer. In this manner, at the end of the first etch process, a layer of dielectric still remains. Gabriel teaches using the change in the impedance of the substrate to determine the point that is just prior to etch-through of the dielectric layer. Then, Gabriel uses a second etch process to etch through the remainder layer of dielectric, using a less aggressive etching method.

As will be fully explained below, the combination of Cain in view of Gabriel does not raise a *prima facie* case of obviousness against independent claims 1, 6, and 16. To establish a *prima facie* case of obviousness based on a combination of references, there must be some suggestion or motivation, either in the references or in the knowledge generally available to one having ordinary skill in the art, to combine the references in the manner proposed. As will be explained below, the Office has not established a *prima facie* case of obviousness against the claimed subject matter because one having ordinary skill in the art would not have combined Cain and Gabriel in the manner proposed by the Examiner.

Contrary to the claimed invention, Cain does not teach, suggest, or disclose forming the dielectric layer directly over the surface of the substrate. Instead, Cain deposits the dielectric layer over the sacrificial stop layer. Second, Cain uses the stop layer as a marker. That is, the endpoint signal of Cain is detected when etching the sacrificial stop layer is initiated. In fact, Cain repeatedly refers to the benefits of using the less aggressive etch process to remove the sacrificial stop layer so that contacts can be etched in the ILD layer without damaging the underlying substrate. Thus, one having ordinary skill in the art would not have been motivated to go against the specific teachings of Cain so as to arrive at the claimed invention, as defined in claims 1, 6, and 16. As can be appreciated, the plasma etch process of the claimed invention has eliminated the need of the stop layer, as the plasma etch process of the claimed invention is discontinued upon detecting an endpoint signaling change in the bias compensation voltage.

Furthermore, Cain does not teach, suggest, or disclose using a bias compensation endpoint detection method, as recited in independent claims 1, 6, and 16. Rather, Cain suggests using optical emission method to detect the endpoint of the dielectric layer followed by etching of the stop layer. Because of the stop layer, there would be no motivation to look at other teachings, such as bias compensation endpoint detection. Still further, bias compensation would not work for Cain since Cain teaches the use of the sacrificial stop layer.

Furthermore, Cain does not disclose, teach, or suggest that etching the ILD results in exposing of a portion of the surface of the substrate. This is in conflict with the Office's contention that in Figure 6F, Cain shows that the etching process exposes a portion of the surface of the substrate.

In a like manner, in contrast to the claimed invention wherein the contact is plasma etched through the dielectric layer and plasma etching process is discontinued upon detecting the signaling of the bias compensation etch endpoint detection, in Gabriel, the bias compensation endpoint detection of the ILD is not used to detect etching through the ILD layer. Rather, Gabriel teaches etching the dielectric layer in two stages using two different plasma etching processes. In this manner, Gabriel treats the ILD layer as two layers, the first layer being the layer up to the point of etch-through in the dielectric layer and the second layer being the remainder of the dielectric layer. Additionally, the bias compensation endpoint detection method of Gabriel detects changes in impedance of the wafer just before etching through the ILD layer. Thus, indirectly, Gabriel uses a stop layer, with the stop layer being the remainder of the dielectric layer. Furthermore, Gabriel does not teach, disclose, or suggest a method for use in fabrication of a self-aligned contact (SAC) structure, since Gabriel is silent as to SAC structures.

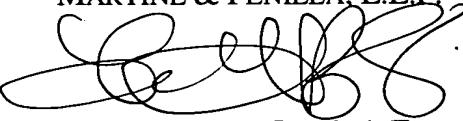
As can be appreciated, modifying Cain using the teachings of Gabriel would in fact add several additional stages to the etch process. During the first etch process, the bias compensation etch endpoint detection method would have to be used to detect the impedance of the wafer up to just before the ILD etch through. Then, the remainder of the ILD layer would have to be removed using a second etch process followed by a third etch process to remove the sacrificial layer of Cain. Among other goals of the claimed invention, having to implement all of these etch processes defeats the goals of reducing fabrication cost and increasing wafer throughput.

The third reference, Liaw, teaches a process for fabricating a MOSFET device for a triple polysilicon SRAM process. Liaw does not disclose, teach, or suggest forming a dielectric layer directly over the surface of the substrate, monitoring the bias level of the plasma etching chamber, or discontinuing the plasma etching process when an endpoint signal change in the bias compensation voltage is detected. Accordingly, nothing is Liaw would cure any of deficiencies in Cain or Gabriel.

Therefore, it is respectfully submitted that independent claims 1, 6, and 16 are patentable under 35 U.S.C. § 103(a) over any combination of the cited prior art. In a like manner, dependent claims 2-5, 7-10, and 17-20 which incorporate each and every element of the respective independent claim 1, 6, and 16 are patentable under 35 U.S.C. § 103(a) over any combination of the cited prior art for at least the same reasons discussed above.

New independent claim 21 includes the features of claims 1 and 2 and is patentable over the combination of the cited prior art. It is submitted that none of the combination of the cited prior art discloses that the endpoint signaling change in the bias compensation voltage is detected when a portion of the surface of the substrate underlying the contact hole is substantially exposed. It should be noted that Cain and Gabriel emphasize not to expose the underlying substrate during the etching processes.

In view of the foregoing, Applicants respectfully submit that all of the pending claims 1-10 and 16-21 are in condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If the Examiner has any questions concerning the present Preliminary Amendment, the Examiner is kindly requested to contact the undersigned at (408) 749-6900, ext. 6913. If any additional fees are due in connection with filing this Amendment, the Commissioner is also authorized to charge Deposit Account No. 50-0805 (Order No. LAM2P258). A duplicate copy of the transmittal is enclosed for this purpose.

Respectfully submitted,
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